



INSTITUTIONEN FÖR
NATURVETENSKAP OCH TEKNIK

Datorteknik för civilingenjörer, DT509G

Datorteknik, teori

A001

5 högskolepoäng

Skriftlig tentamen

2023-08-18

Programmering grundkurs, DT509G (A001)

Tillåtna hjälpmedel: penna, radergummi, engelska-svenska ordbok

Instruktioner:

- *Läs igenom alla frågor noga.*
- Ange tentamenskoden på svarsdokumentet.
- Du kan svara på *Svenska* eller *Engelska*.
- *Skriv tydligt* (gäller även för en digital tentamen).
- Detta är en individuell examination - alla misstankar om otillåtet samarbete kommer att rapporteras.
- Ansvarig lärare finns tillgänglig via telefon fr.o.m. andra skrivtimmen.
- Skriv läsligt!
- förklara och motivera era svar

Ansvarig lärare: Pascal Rebreyend, tel: 0702001422

(NOTE: Since the exam is on Saturday, send an SMS and I'll call you back as soon as I can)

För betyg G krävs 50% av total poäng (20 på 40)

(26 poäng gav betyg 4, och 33 poäng gav betyg 5)

Lycka till!

Question 1 (8 points)

For each of the following sentences, are they correct or wrong (justify our answer)

- The size of a struct is the sum of the sizes of each of its elements
- 1Kb is 1000 bytes
- One CPU instruction can take more one clock cycle
- A CPU with a single core is using in fact some parallelism to compute faster

Question 2 (3 points)

Compilers are able to reorder the C or/and assembly code in order to produce faster executables. But why and how this works?

Question 3 (6 points)

You have to store a bi-dimensional array (matrix/table) of integers. Each line of the table represent information about a students(like which courses are taken/passed by the corresponding student, when and with which grades,...). Every column represent a single course or particular type of information.

How you will store the table in memory (you are welcome to give an example of C-code) if:

- The main usage of the table is to compute statistics about one (or several) courses.
- The main usage of the table is to have global information about one student (what is he/she studying now, how many points he/she has,...).

Question 4 (4 points)

When a compiler is compiling a code to an ARM CPU, what is done by the compiler in order to call (and get back from) a function? Describe all mechanisms and how parameters are passed to the function.

Question 5 (5 points)

You are working for a compagny which own a lot of assembly codes embedded in their products. Unfortunatly, the processor used so far is not anymore produced and a new processor should be used. The new processor is faster and has exactly the same set of instructions. Aside its speed, the only difference is that the new processor has only 16 registers while the previous one had 24 registers. How you will solve this problems? Give at least two different solutions (which can be different in term of cost and efficiency).

Question 6 (6 points)

Let be A and B two real numbers stored using the classical floating point representation. Unfortunately, the cup used has no operator to multiply together 2 floating point numbers. Write a C-code which will compute the product of A*B. (You can see A and B as an array of bits to simplify the code)

Question 7 (5 points)

What will be displayed by the following code?

```
#include <stdio.h>
#include <stdlib.h>

int f1(int *x)
{
    long unsigned int a,b;
    int k;
    a=(long unsigned int)x;
    x++;
    b=(long unsigned int)x;
    k=b-a;
    return(k);
}

int f2(char x)
{
    long unsigned int a,b;
    int d;
    a=(long unsigned int)x;
    x++;
    b=(long unsigned int)x;
    d=b-a;
    return(d);
}

void main()
{
    int *a;
    char *b;
    int c;
    a=calloc(100,sizeof(int));
    b=calloc(100,sizeof(char));
    c=f1(a)-f2(*b);
    printf("%d\n",c);
}
```

Question 8 (3 points)

Why virtual memory is important?